

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Understanding Northern Latitude Vegetation Greening and Browning - A Workshop

December 6-7, 2018

Keck Center, Room 201
500 5th Street NW, Washington DC

AGENDA

Workshop Goal: to discuss the current state of knowledge regarding patterns and shifts in tundra and boreal vegetation productivity (i.e. greening and browning), as well as knowledge gaps and challenges, and opportunities to address these issues to improve understanding.

Day 1: Thursday, December 6, 2018
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8:30 AM	Breakfast available	Keck 201
9:00 AM	Welcome and introductions	Scott Goetz, Chair Northern Arizona University

Session 1: Observed patterns and identified drivers of tundra and boreal forest vegetation productivity
Session objective: to discuss observed patterns of vegetation productivity in tundra and boreal forests from remote sensing and ground-based measurement observations.

Session moderator: Elizabeth Campbell, Natural Resources Canada

9:30 AM	Global patterns of greening and browning, with some focus on high latitude ecosystems Wolfgang Buermann, University of Leeds
9:45 AM	Observed patterns in Arctic tundra Logan Berner, Northern Arizona University
10:00 AM	Observed patterns in boreal forest Sylvie Gauthier, Canadian Forest Service
10:15 AM	Break

Session 1 Continued: Identified drivers of vegetation patterns and change

- 10:30 AM **Land cover change and disturbance**
Jonathan Wang, Boston University
- 10:40 AM **Pulse disturbances (e.g. fire, thermokarst, extreme drought & weather events)**
Ben Bond-Lamberty, Pacific Northwest National Laboratory
- 10:50 AM **Press disturbance – insect pests**
Arjan Meddens, University of Idaho
- 11:00 AM **Session 1 questions and discussion**

General discussion questions:

- What factors drive changes in vegetation productivity across the landscape and over time?
- What can be learned from observations of ‘flipping’ from increasing to decreasing productivity (or vice versa) and interannual variability?
- How well can we predict future Arctic Boreal Region vegetation dynamics given current understanding of drivers? What are the primary unknowns and poorly quantified drivers?

12:00 PM Lunch

Session 2: Methods and tools for evaluating patterns and changes in northern latitude vegetation

Session objective: to discuss datasets, current observing systems, and their strengths and weaknesses in identifying vegetation change. The session will also explore promising new technologies and other metrics that can improve understanding of vegetation dynamics, and how satellite and field-based approaches can be better integrated to address discrepancies in observed vegetation patterns and changes.

Session moderator: Eugenie Euskirchen, University of Alaska Fairbanks

Field-scale measurements and uncertainties

- 1:00 PM Isla Myers-Smith, University of Edinburgh
- 1:10 PM Elyn Humphreys, Carlton University

Remote sensing and uncertainties

- 1:20 PM Christopher Neigh, NASA Goddard Space Flight Center
- 1:30 PM Alexei Lyapustin, NASA Goddard Space Flight Center

New technologies to reduce uncertainties

1:40 PM Xi Yang, University of Virginia

1:50 PM Doug Morton, NASA Goddard Space Flight Center

2:00 PM **Session 2 questions and discussion**

General discussion questions:

- Are current observing systems (e.g. satellite, field measurements, models) adequate for identifying vegetation change and providing information needed to understand the factors influencing vegetation dynamics? How can they be improved?
- What remote sensing datasets are available for evaluating tundra and boreal vegetation change and what are their strengths and weaknesses?
- What are promising technologies beyond optical remote sensing that can improve understanding of vegetation dynamics?
- Are there other new metrics, methods, or measurement tools that could improve understanding of observed changes?
- How can satellite and field-based approaches be better utilized jointly to address discrepancies in observed vegetation patterns and changes?

3:00 PM Break

Breakout Session A: Identification of gaps and challenges

Session objective: To expand on the topics discussed earlier in the day and identify critical knowledge, research, and methodological gaps and existing barriers/challenges that need to be addressed to improve understanding of northern latitude vegetation dynamics.

3:15 PM Introduction and instructions for breakouts Scott Goetz, Northern Arizona University
(see last page of agenda for details)

3:25 PM Breakout session

4:30 PM Break

4:45 PM **Reconvene, report out on breakout sessions, and general discussion**
Moderator: Scott Goetz, Northern Arizona University
Rapporteurs from each group present

5:30 PM Adjourn

6:00 PM Group dinner (optional). Participants pay for their own meals.

Day 2: Friday, December 7, 2018

8:30 AM Breakfast available Keck 201

9:00 AM Introduction to Day 2 agenda Scott Goetz, Chair
Northern Arizona University

Session 3: Implications for tundra and boreal vegetation change

Session objective: to discuss a range of impacts that vegetation changes in tundra and boreal forest ecosystems may have.

Session moderator: Ben Poulter, NASA Goddard Space Flight Center

9:20 AM **Albedo/energy feedbacks**
Tom O'Halloran, Clemson University

9:30 AM **Biophysics**
Adrianna Foster, Northern Arizona University

9:40 AM **Ecological implications**
Michelle Mack, Northern Arizona University

9:50 AM Break

10:15 AM **Wildlife**
Elie Gurarie, University of Maryland

10:25 AM **Socioeconomic perspective**
Jen Schmidt, University of Alaska Anchorage

10:35 AM **Session 3 questions and discussion**

General discussion questions:

- How well can we quantify the effects of shifts in tundra and boreal forest vegetation on albedo feedbacks and energy balance?
- What are the impacts of vegetation composition and productivity changes on other biota (e.g. birds and mammals)? And on society?
- How do vegetation productivity changes influence soil warming and associated changes in permafrost thaw and carbon cycling? (and vice versa)
- Are there hydrological changes that are influencing observed vegetation shifts? Conversely, are shifts in vegetation altering hydrological processes?
- How might variability in greening versus browning on annual or multi-year timescales influence these potential implications?

11:45 AM Lunch

Breakout Session B: Opportunities to address gaps and challenges

Session objective: to brainstorm ways in which the gaps and challenges identified in Breakout Session A on Day 1 can be addressed to advance understanding. The implications discussed in the morning session and other implications participants may want to raise can also be brought into the conversation. Implications could serve as a motivator to address specific gaps, or as a way to prioritize which gaps are of highest importance to tackle first.

12:45 PM	Introduction and instructions for breakouts (see last page of agenda for details)	Scott Goetz, Northern Arizona University
12:55 PM	Breakout session	
2:00 PM	Break	
2:20 PM	Reconvene and report out on breakout session discussions Moderator: Scott Goetz, Northern Arizona University Rapporteurs from each group present	
3:15 PM	Closing remarks	
3:30 PM	Adjourn	

Breakout Session Information

Breakout Session A: Identification of gaps and challenges

You have now heard about observed vegetation patterns, drivers of patterns and changes, and various methodologies (and their uncertainties) used to evaluate patterns and change. Using information gained through these presentations, as well as your expert knowledge and experience, consider the discussion questions below. Also consider ongoing efforts that may be addressing these types of questions, such as ABoVE, NGEE Arctic, LTER, NEON, SPRUCE, FLUXNet (CO₂ + CH₄), NASA Decadal Survey, IARPC, etc. Groups can provide as many answers as they wish for each question.

Suggested discussion questions:

- What are the major knowledge gaps in current understanding of northern latitude vegetation dynamics and change?
- What are the research questions that need to be asked to address these gaps?
- What existing methodologies or tools are available to explore these questions?
- Are there new or emerging technologies that can be used to advance knowledge and fill these gaps?
- Are there barriers or challenges (logistics, methods, etc.) that have contributed to the existence of the identified gaps? If yes, what are they?

Breakout Session B: Opportunities to address gaps and challenges

Considering the gaps and existing barriers/challenges identified on Day 1 (as well as others that may come to mind), address the following questions.

Suggested discussion questions:

- Are there research or methodological gaps that may be relatively straightforward to address in the near term? If yes, what are they?
- Are there opportunities to better leverage existing or emerging methods/technologies to address gaps, including coupling of field measurements and remote sensing approaches?
- Are there implications of vegetation change that may inform how or when to address gaps? If yes, how might this be done?
- Which gap(s) does the group think are most pressing to address and what may be the approach/approaches that seem most likely to be effective?